Name: _____

1. [**2 points**] The following is pseudocode for a program that takes a non-negative integer x as input and outputs $x!$. Find the loop invariant Q.

```
Factorial(x):
    i = 2
    j = 1
    while i ≠ x + 1 do
        j = j * i
        i = i + 1
    end while

    //j now has the value x!
    return j
```

2. [**2 points**] Use the Euclidian algorithm to find $\gcd(2622, 627)$. Show the intermediate steps of the Euclidian algorithm; no credit for answers that do not use the Euclidian algorithm.

3. [**2 points**] Write the first 4 values of the sequence given by $A(1) = 3$, $A(2) = -1$, and $A(n) = 2A(n-1) + A(n-2)$.

4. [**2 parts, 1 point each**] A collection S of strings is defined recursively by

   1. The empty string λ belongs to S.
   2. The strings a and b belong to S.
   3. If X belongs to S, then aXa and bXb belong to S.

   (a) Write down three (3) different strings of length 4 that are in S.

   (b) Give a simple, non-recursive definition of S that is equivalent to the given definition.

5. [**2 points**] Give a recursive definition of x^R, the reverse of the string x.